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(54) REDUCED ENVIRONMENTAL LOAD TYPE LUBRICATING OIL COMPOSITION

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an environmentally friendly lubricating oil composition significantly improving performances of heat resistance and cleaning ability under a condition continuously driven for a long time and reduced in amounts of chlorine compounds and sulfur compounds in the composition.

SOLUTION: This lubricating oil composition is characterized by comprising 0.1–50 mass% of an alkaline earth metal salt of alkylsalicylate and having ≤10 ppm of chlorine content therein measured by test method of ASTM D 6443.

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CLAIMS

[Claim(s)]

[Claim 1]A lubricating oil composition characterized by the following.

0.1 to alkyl salicylate alkaline earth metal salt 50 mass %.

And a chlorine content (it measured with ASTM D 6443 test method) in a lubricating oil composition is 10 ppm or less.

[Claim 2]The lubricating oil composition according to claim 1 whose sulfur content (it measures by a method of ASTM D 5185 statement) in a lubricating oil composition is below 0.65 mass %.

[Claim 3]Two or more kinds of alkyl salicylate alkaline earth metal salt in which sulfuric acid ash contents (based on JIS K 2272) differ are used, The lubricating oil composition according to claim 1 or 2 in which alkyl salicylate alkaline earth metal salt below 10 mass % occupied not less than 50% in all the alkyl salicylate alkaline earth metal salt in a sulfuric acid ash content.

[Claim 4]claims 1-3 containing dialkyl phosphorodithioate zinc -- either -- a lubricating oil composition of a statement.

[Claim 5]claims 1-4 in which said alkyl salicylate alkaline earth metal salt is alkyl salicylate calcium salt -- either -- a lubricating oil composition of a statement.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This inventions are the conditions by which prolonged continuous running is carried out, and relate to the environment-friendly lubricating oil composition which raised the performance of heat resistance and a detergency substantially and reduced the chlorine compound and sulfur compound in a constituent.

[0002] This invention relates to the lubricating oil composition which controlled the content of the chlorine compound in a constituent, and the sulfur compound, and can control these compounds and oxides out of engine emission gas, and it relates to the lubricating oil composition which maintains the detergency excellent in the bottom of prolonged continuous-running conditions over a long period of time.

Although it is a lubricating oil composition applicable to internal combustion engines for marine and all the internal-combustion engines for land, it is related with the lubricating oil composition which fitted internal combustion engines for marine especially.

[0003]

[Description of the Prior Art] Although the regulation of exhaust gas which considers the internal-combustion engine for land as a reason had been regulated severely, since the air pollution from a marine vessel was distant from the terrestrial area where human being lives if a port and a coastal area are removed, it was seldom made an issue of until now. It becomes serious SUBJECT which must be tackled on a global scale to the problem and global warming issue of acid rain which destroy a forest and a lake, and it is impossible however, to ignore also about the air pollution substance from a marine vessel in recent years. For this reason, in Maritime Environment Protection Committee of the International Maritime Organization (IMO:International Maritime Organization) which will be one of the specialized agencies of United Nations around 1990, A "MARPOL73/78 treaty (protocol in 1978 about international treaty for prevention of contamination by marine vessel in 1973)" new schedule was adopted at the contracting State meeting held in September, 1997 about the air pollution prevention from the deliberated marine vessel. They are for the contents of regulation to manufacture about NOx the organization that a discharge becomes below in a restriction value, and to regulate the sulfur content contained in fuel oil about checking by periodical inspection, and SOx.

[0004] By marine vessel, most main promotive bodies are diesel power plants. A lot of sulfur content is contained in gas oil and the fuel oil which are the diesel-power-plant fuel for marine vessels, and a sulfur oxide (SOx) is contained in the exhaust gas discharged with combustion. From a diesel power plant, nitrogen in the air becomes nitrogen oxides (NOx), serves as exhaust gas, and is discharged by combustion. Both a sulfur oxide and nitrogen oxides are the causative agents of acid rain, and they have to reduce.

[0005] In exhaust gas, water is also contained with a sulfur oxide, these react, and sulfuric acid is generated. Some generated sulfuric acid brings a result included in engine oil, and it will corrode the member of an engine interior and will be worn out. Therefore, under the present circumstances, the metal system detergent additive which has basicity is added so much in

comparison, and this sulfuric acid is neutralized.

[0006]The environmental pollution problem by the particulate matter (PM) which can be included into exhaust gas is serious. It is announced that PM with a particle diameter of 2.5 micrometers or less named PM2.5 generically based on the surveillance study of Roger.O.McClellan and a Frederic.J.Miller car doctor of US Environmental Protection Agency is harmful to a human body. PM consists of a soluble organic component (SOF) which is unburned combustibles of sulfate, soot and fuel resulting from the sulfur content in fuel, and a lubricating oil. Among these, it is said that the rate of a SOF ingredient over all the PM is 30 to 40%. These aftertreatment apparatus are carried in the diesel power plant for land for the purpose of emission gas purification recently [, such as a SOF oxidation catalyst which a SOF ingredient is oxidized and is reduced, and DPF which carries out the filter trap of the PM and reduces it,].

[0007]However, when comparatively many the base oil and the additive agents which contained sulfur and chlorine in engine oil are added, the sulfur oxide and chlorine compound in which engine oil originates in engine oil since a part burns with fuel by a combustion chamber will be contained in exhaust gas so much. As for these sulfur oxides, it is not preferred environmentally to check work of an aftertreatment apparatus, or for it to be emitted as it is and to affect air pollution etc. However, although there are many portions still strange about the degree of incidence at the time of the compound which considers a part for the sulfur content in an old place and a lubricating oil oil or chlorine as a reason being emitted into the atmosphere, it may develop into a future big problem. Although recent years come and there are JP,10-121081,A and JP,10-121082,A as an invention of a ship engine oil composition, it does not argue about the additive agent which persalt group nature alkali earth metal phenate containing many sulfur content is blended, and contains chlorine. Although there are JP,10-279980,A and JP,10-287893,A as same art, the sulfur containing antioxidant containing sulfur is blended and there is no argument about the additive agent containing chlorine. Some engine oil burns with fuel by a combustion chamber, or it is emitted into the atmosphere with exhaust gas with engine oil itself. In that case, it is important for a sulfur oxide and a chlorine compound to be contained in exhaust gas, and to reduce the load to environment from now on.

[0008]

[Problem(s) to be Solved by the Invention]The purposes of this invention are the conditions by which prolonged continuous running is carried out, and are at the point of having raised the performance of heat resistance and a detergency substantially and having reduced the chlorine compound and sulfur compound in a constituent and of providing an environment-friendly lubricating oil composition.

[0009]

[Means for Solving the Problem]Without using a sulfur compound and a chlorine compound as much as possible that this invention person should develop a combination formula used as a base for manufacturing a lubricating oil composition which solved said SUBJECT, as a result of repeating research wholeheartedly under actual engine operating conditions, It finds out that it becomes possible to provide a lubricating oil which has the detergency outstanding under an elevated temperature over a long period of time with an internal-combustion-engine-oil constituent (combination formula) by combination of a specific salicylate system cleaning agent and a specific base oil presentation, and came to complete this invention.

[0010]It is related with a lubricating oil composition which contains alkyl salicylate alkaline earth metal salt 0.1 – 50 mass % the first of this invention, and is characterized by a chlorine content (it measured with ASTM D 6443 test method) in a lubricating oil composition being 10 ppm or less.

[0011]The second of this invention is a sulfur content (although a thing of the range of 0.09 to 0.60% of a sulfur content is also made into an object in ASTM D 5185) in a lubricating oil composition. in this invention, what surpasses 0.60% is measured by a method of a statement to ASTM D 5185 as an object of measurement -- **** -- it is related with the lubricating oil composition according to claim 1 which is below 0.65 mass %.

[0012]Two or more kinds of alkyl salicylate alkaline earth metal salt in which sulfuric acid ash contents (based on JIS K 2272) differ are used for the third of this invention, A sulfuric acid ash

content is related with the lubricating oil composition according to claim 1 or 2 in which alkyl salicylate alkaline earth metal salt below 10 mass % occupied not less than 50% in all the alkyl salicylate alkaline earth metal salt.

[0013]a claim in which the fourth of this invention contains dialkyl phosphorodithioate zinc — it is related with a lubricating oil composition of a statement one to 3 either.

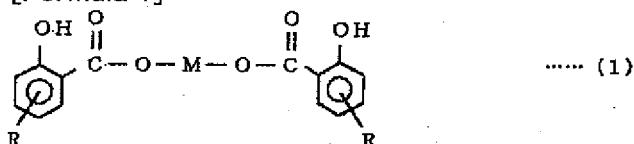
[0014]a claim in which said alkyl salicylate alkaline earth metal salt is alkyl salicylate calcium salt the fifth of this invention — it is related with a lubricating oil composition of a statement one to 4 either.

[0015]

[Invention embodiment] Alkyl salicylate alkaline earth metal salt used for a lubricating oil composition of this invention, it is shown in the Japan patent No. 1271215 which a shell group owns, and No. 1031507 — as — the [between aromatic carboxylic acid and the atomic numbers 12–56 / periodic table] — it is oil-soluble basic salt with II group metal, and the total basicity is included by 12 or more mgKOH/g. A thing of 50 – 400 mgKOH/g has the preferred total basicity of alkyl salicylate alkaline-earth-metal-salt itself as an additive agent for lubricating oil compositions of this invention. It is preferred that especially alkaline earth metal salt is calcium and magnesium. As it is in JP,2000-63876,A, alkyl salicylate magnesium salt, Even if it carries out mixed combination of alkyl salicylate magnesium salt and the alkyl salicylate calcium salt, It turns out that it has the clarification performance outstanding like the time of combination of only alkyl salicylate calcium salt, and an effect which used together with alkyl salicylate calcium salt, and was excellent in the range which does not spoil performance is done so.

[0016]It is an organic compound (1), an inorganic compound (2), and a mixture of (3) which are shown with alkyl salicylate alkaline earth metal salt in this invention in a following formula.

[Formula 1]



MCO₂

..... (2)

M(OH)₂

..... (3)

[0017]Among said formula, although R is an alkyl group, it is preferred that average alkyl chain length is the carbon numbers 10–35. The dispersibility in an oil falls that average alkyl chain length is with a carbon number of ten or less short chain length, and a detergency is inferior, and acid neutralization performance is inferior in his being chain length longer than the carbon number 35. When [which does not go the performance which neutralizes the acid which the inorganic compound distributed in the lubricating oil stably, and was made into the lubricating oil by oxidation degradation] demonstrating that there is nothing, the chain length of the alkyl group of an organic compound is bearing the important role. It is alkaline-earth metals, and M in said formula (1), (2), and (3) has calcium, magnesium, and preferred barium, and especially its calcium is preferred. The alkyl salicylate alkaline earth metal salt which is an organic compound shown by said formula (1) has the preferred mode which exists in a form which encloses the core which consists of an inorganic compound shown by said formula (2) and (3).

[0018]In a lubricating oil composition of this invention, addition of dialkyl phosphorodithioate zinc (ZnDTP) is preferred as an abrasion proof agent. While addition of ZnDTP prevents engine wear, it can also prevent oxidation of a lubricating oil. Although an alkyl group in particular of ZnDTP is not restricted, the carbon numbers 3–12 are usually preferred. the alkyl group — the 2nd class alkyl group (Sec-ZnDTP) — and — or the 1st class alkyl group (Pri-ZnDTP) — and — or it is preferred that an aryl group (Aryl-ZnDTP) is blended. Usually, it is 0.3 to 5 % of the weight, and is 1 to 2 % of the weight preferably. However, in being a use as which abrasion proof performance to an engine part is not required, there is no necessity of adding an abrasion proof agent in a

lubricating oil composition.

[0019]as lubricating oil 100 mass for internal combustion machines % from which loadings of alkyl salicylate alkaline earth metal salt used in this invention serve as a final product --- the loadings --- one to 50 mass % --- desirable --- 2 - 45 mass % --- comparatively --- carrying out . It is preferred 0.1 to 10 mass % and that adjust so that it may become 0.2 - 9 mass % preferably, and a sulfuric acid ash content of a lubricating oil composition specified by JIS K 2272 determines loadings of these salicylate metal salt.

[0020]a carbonization residue which a sulfuric acid ash content shows quantity of metal system cleaning agent additive agents (alkyl salicylate calcium salt etc.) contained in a lubricating oil, burned a sample, and was produced --- sulfuric acid --- in addition, it is the ash (the examining method: JIS K 2272) displayed in fixed quantity as sulfate. If there is generally much sulfuric acid ash, it is said in an elevated-temperature detergency examination represented by hot tube examination that a good result is obtained (since an addition of a metal system cleaning agent increases inevitably).

[0021]A sulfur content originates mainly in base oil or an abrasion proof agent. However, although some metal system cleaning agents contain sulfur in the structural formula, for example, alkyl sulfonate calcium salt (the metal system cleaning agent C in a specification) and alkyl FINETO calcium salt (the metal system cleaning agent D in a specification) contain sulfur, Said alkyl salicylate alkaline earth metal salt used by this invention does not contain sulfur substantially.

[0022]an ash-free system --- a dispersing agent usually being blended at a rate of 0.1 - 20 mass %, and as the kind, Poly alkenyl amber acid imide, poly alkenyl amber acid ester, etc. which are shown in the Japan patent No. 1367796 which a shell group owns, No. 1667140, No. 1302811, and No. 1743435 are mentioned. It is preferred to use poly alkenyl amber acid imide of less than 1.6% of nitrogen content content and poly alkenyl amber acid ester. an ash-free system whose nitrogen content is low as for it --- a direction of a dispersing agent is because it is efficiently desirable. an ash-free system with nitrogen volume content actually high in the past --- an ash-free system which has the clarification performance which was excellent even if especially a nitrogen content was low in recent years although a dispersing agent is generally said to be good for diesel power plants and was continuing being used --- a dispersing agent also began to be marketed. Poly alkenyl amber acid imide is obtained at a reaction of alkenyl anhydrous amber acid or alkenyl anhydrous amber acid, and polyamine. It is preferred that a prescription is written so that a nitrogen content in a lubricating oil composition may be 0.01% or more, but it is preferred to make it to 0.3% or less at the maximum. A case where neither soot mixed into a lubricating oil nor generated sludge can be maintained at a stable dispersion state unless it is contained arises at least 0.01%.

[0023]As an antioxidant, for example Phenolic antioxidants, such as 2,6-di-t-butylphenol and 4,4'-methylenebis (2,6-di-t-butylphenol), Amine system antioxidants, such as alkylation diphenylamine, phenyl-alpha-naphthylamine, and alkylation-alpha-naphthylamine, etc. are mentioned, and these can be used at a rate of 0.01 - 2 mass %.

[0024]It is also effective in a lubricating oil composition of this invention to add a proper quantity of other various additive agents by request. As other additive agents, pour point depressant, a defoaming agent, a rust-proofer, a demulsifier (what is used in order to destroy an emulsion and to separate into the 2 liquid phase), a metal deactivator, and a viscosity index improver may be used according to the purpose. As pour point depressant, the Japan patent No. 1195542, a polymethacrylate system indicated to No. 1264056, etc. are used. As a defoaming agent, silicone, fluorosilicone, fluoro alkyl ether, dimethyl polycyclohexane, polyacrylate, etc. are used. As a rust-proofer, petroleum sulfonate, alkyl benzene sulfonate, dinonylnaphthalene sulfonate, alkenyl amber acid or its ester derivative, multivalent alcohol ester, a benzotriazol system compound, a thiadiazole system compound, etc. are used. As a demulsifier, polyalkylene glycol system non-ion system surface-active agents, such as polyoxyethylene alkyl ether, polyoxyethylene alkyl phenyl ether, and polyoxyethylene alkyl naphthyl ether, etc. are used. As a metal deactivator, imidazoline, a pyrimidine derivative, alkyl thiadiazole, Mercaptobenzothiazole, benzotriazol or its derivative, mercaptobenzothiazole, thiadiazole or its derivative, benzimidazole or its derivative,

propene nitrile, or its derivative is used. As a viscosity index improver, 0.01–20 weight-section combination is carried out to internal-combustion-engine-oil constituent 100 weight section. The Japan patent No. 954077 which a shell group owns as a viscosity index improver, for example, A styrene butadiene copolymer indicated to No. 1031507, No. 1468752, No. 1764494, and No. 1751082, A styrene isoprene star-like copolymer, a polymethacrylate system, ethylene propylene rubber, etc. are mentioned, and these are used at a rate of 1 – 20 mass % to the whole quantity. It can be similarly used about a distributed viscosity index improver which carried out copolymerization of the polar monomer which contained a nitrogen atom and an oxygen atom in a molecule to these things.

[0025]It is in formula art of a lubricating oil presentation which controls generation of sulfate ion as one of the reasons which has a detergency and heat resistance excellent in a lubricating oil composition of this invention. The sulfate ion generated in a lubricating oil can consider generating by degradation of an additive agent containing a sulfur element contained in combustion and an internal-combustion-engine-lubricant constituent of a sulfur compound contained in fuel as generally known. Alkyl salicylate metal salt which is the main lubricating oil compositions of this invention, A sulfur element used as generating of this sulfate ion is not included in a compound, but since it is the combination formula which can control sulfate ion generation, an additive agent's own decomposition is controlled, it is thought that work of the additive agent itself can be promoted, and it is possible to heighten a detergency and acid neutralizing capacity. A lubricating oil composition of this invention demonstrates performance outstanding also as a lubricating oil for not only a ship diesel engine but an automobile engine for land, and engines which use fuel gas. Especially a thing included for neither sulfur nor a chlorine compound as much as possible now also from the side which is generally reusing a used lubricating oil of an automobile engine oil for land as fuel becomes very important in respect of environmental protection.

[0026]A lubricating oil composition of this invention distributes capability and a combustion residue thing which neutralize promptly acidic components, such as sulfurous acid generated at the time of combustion, It is the environmental impact reduction type internal-combustion-engine-oil constituent which excelled in capability which prevents deposition in a piston liner and a piston-ring groove in a combustion chamber in an engine, and is kept pure.

[0027]

[Example]Although an example and a comparative example are given and explained about this invention below, this invention is not limited only to these examples. Each engine oil composition which has the presentation shown in Table 1 was prepared, and these performance evaluation tests were done. A test result is shown in Table 1.

[0028]The heat resistance of a sample offering oil and a detergency were evaluated using <hot tube examination> hot tube circuit tester test equipment (made by Komatsu Engineering). This device evaluates the elevated-temperature detergency of engine oil by lacquer concentration of a glass test tube. According to the procedure provided in JPI-5S-55-99 (engine oil-hot tube test method), the A method (marks method) estimated the test method. Zero point is made the worst (when deep-black), and the result about a detergency judges ten points as best as specified by the examining method (when water-white).

[0029]The base oil presentation of all the test oil was based on the presentation of standard engine oil. The clarification performance under an elevated temperature and the value of the deeply related total basicity were blended so that each sample oil might become 40 mgKOH/g. Base oil A-C in an example and a comparative example has the following kinds and descriptions.

[0030]17.6mm²/s and 40 ** kinetic viscosity A:100 ** of base oil kinetic viscosity 138.0mm²/s, The synthetic base oil of the polyol-ester compound of the pentaerythritol hindered ester system which has description of the viscosity index 140, pour point-27 **, 300 ** of flash points, and 1 % of the weight of the amounts of evaporation losses was used.

[0031]The high-viscosity-index base oil which B:100 ** of base oil kinetic viscosity calls 8.15mm²/s, and 40 ** kinetic viscosity calls 47.9mm²/s, the viscosity index 144, pour point-20 **, and 260 ** of flash points was used.

[0032]As high-viscosity-index base oil, *** (slack wax) separated by solvent dewaxing is used as a raw material, The lubricant base oil which has 130 or more (typically 140-155) viscosity indices obtained by carrying out hydrocracking (catalytic cracking) of this under existence of a catalyst, and isomerizing a normal paraffin to a branched paraffin, Or it is considered as a heavy normal paraffin by the Fischer Tropsch polymerization by using as a raw material hydrogen and carbon monoxide which are obtained by the gasification process (partial oxidation) of natural gas (methane etc.), Although the lubricant base oil which has 130 or more (typically 140-155) viscosity indices obtained in this by the same thing as the above-mentioned to do for catalytic-cracking isomerization is mentioned, the base oil used here is not limited to either.

[0033]Base oil C: It is the mineral oil base oil which is independent as for solvent refining base oil or hydrorefining base oil, or contains 0.40 mass % for the sulfur content of the mixture. What was prepared so that base oil viscosity might become SAE(Society of Automotive Engineers) 40 grade was used. Kinetic viscosity [in / in SAE40 grade / 100 **] is a thing of the viscosity range of 12.5-16.3-mm²/s.

[0034]the kinetic viscosity which can set 100 ** of descriptions of the base oil used for this invention -- 2-80mm²/s -- it is 4-50mm²/s preferably. Lubricity falls [the kinetic viscosity at 100 **] by less than 2 mm²/s here, and seizure-proof nature is inferior, and resistance by the viscosity in an engine interior becomes large above 80-mm²/s, and it is not desirable from a viewpoint of decline in gas mileage etc.

[0035]About the viscosity index of the base oil used by this invention, it is 80 or more preferably 75 or more. A viscosity index is not preferred as base oil of a flat knot internal-combustion-engine-oil constituent at less than 75 from the lubricative aggravation due to the startability in low temperature, and a hot viscosity down.

[0036]The additive agent presentation of all the test oil was based on the additive agent presentation of a standard ship lubricating oil. namely, a metal system cleaning agent and an ash-free system -- a dispersing agent, a defoaming agent, etc. are blended.

[0037]Especially about the metal system cleaning agent, alkyl salicylate calcium salt, alkyl sulfonate calcium salt, and alkyl FINETO calcium salt were used. The additive agent of metal system cleaning agent A-D in an example has the following descriptions.

Metal system cleaning agent A (alkyl salicylate calcium salt) : Total basicity (hydrochloric acid method) 160 mgKOH/g, Total basicity (perchloric acid method) 170 mgKOH/g, the 20.4% of sulfuric acid ash metal system cleaning agent B (alkyl salicylate calcium salt) : Total basicity (hydrochloric acid method) 69 mgKOH/g, Total basicity (perchloric acid method) 70 mgKOH/g, the sulfuric acid ash 8.6 mass % metal system cleaning agent C (alkyl-sulfonate calcium salt) :

Total basicity (hydrochloric acid method) 292 mgKOH/g, Total basicity (perchloric acid method) 300 mgKOH/g, the sulfuric-acid ash 40.8 mass % metal system cleaning agent D (alkyl FINETO calcium salt): Total basicity (hydrochloric acid method) 250 mgKOH/g, total basicity (perchloric acid method) 254 mgKOH/g, and sulfuric acid ash 30.9 mass % [0038]The alcohol residue of the dialkyl dithio phosphoric acid zinc as an abrasion proof agent is the commercial item in which the main ingredients used the 1st class alcohol residue of the carbon numbers 4-6 as the main ingredients by the 1st class. Although the dialkyl dithio phosphoric acid zinc which uses the 1st class as the main ingredients is liked as an abrasion proof agent and used into the lubricating oil composition for marine vessels from an advantage excellent in thermal stability, it does not limit especially the 1st class as the main ingredients.

[0039]

[Table 1]

	実施例 1	実施例 2	実施例 3	実施例 4	比較例 1	比較例 2	比較例 3
配合量 (質量%)	金属系清浄剤 A	24.0	12.0	12.0	12.0		
	金属系清浄剤 B		30.0	30.0	30.0		
	金属系清浄剤 C				14.0		
	金属系清浄剤 D					15.7	
	耐摩耗剤			+1.0			
	基油 A			45.5	45.5		
	基油 B			12.0	12.0		
代表性状	基油 C	75.5	57.5		85.5	83.8	
	その他の添加剤	0.5	0.5	0.5	0.5	0.5	
硫酸灰分量、質量%	硫酸灰分量、質量%	4.9	5.0	5.0	5.2	5.7	4.9
	硫酸灰分量(うち清浄剤由来)、質量%	4.9	5.0	5.0	5.0	5.7	4.9
	全堿基価(過塩素酸法)、mgKOH/g	40.0	40.0	40.0	40.0	40.0	40.0
	カルシウム含有量、質量%	1.5	1.5	1.5	1.5	1.6	1.5
	塩素含有量、ppm	<5	<5	<5	<5	37	26
	硫黄含有量、質量%	0.62	0.63	0.23	0.46	0.85	1.32
	リン含有量、質量%	0.00	0.00	0.00	0.10	0.00	0.05
結果	動粘度100°C	13.89	14.20	14.02	14.10	14.02	13.90
	ホットチューブ試験 離点(310°C)	8.5	9.0	9.5	9.5	0.0	6.5

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[0040]When Example 1, the comparative example 1, and the comparative example 2 are compared, in the formula using the same base oil C, it turns out that alkyl salicylate calcium salt has the detergency capability to have excelled alkyl sulfonate calcium salt and alkyl FINETO calcium. When the chlorine content in that case is measured, it turns out that what has a few chlorine content is excellent in detergency capability. Even if it compares Example 1 and Example 2 with the comparative example 3, the direction of what has a clearly few chlorine content is excellent. It has the detergency which contained alkyl salicylate calcium salt and in which the direction of what has a low chlorine content was excellent. Naturally the shape of representativeness in front shows the description of the lubricating oil composition of each example and a comparative example. The total basicity in front adjusts the blending ratio of each additive agent, and arranges it with 40 mgKOH/g. Although it is a reason for having arranged the value of the total basicity, sulfuric acid ash also becomes high and the oil with the high total basicity has high elevated-temperature clarification performance. Therefore, when selling as goods, it is not an overstatement although the value of this total basicity has determined that commodity value. When the value of this total basicity predicts the performance of that lubricating oil in the business of the engine oil for marine vessels especially, it is taken dramatically seriously. Then, if other combination conditions differ even if the value of the total basicity is fixed, the total basicity compares and it is the same value, it is shown that performance difference appears greatly.

[0041]Even if the combination of the alkyl salicylate calcium salt of the same metal system cleaning agent as Example 1 is used for Example 3, in a combination system with the synthetic base oil which does not contain sulfur content, it turns out that performance difference appears notably. When Example 3 is compared with Example 4, in the grade in which the sulfur content (it originates in an abrasion proof agent) whose abrasion proof agent is a grade added 1% is contained, it turns out that influence does not give in any way at the performance under an elevated temperature. Although it can say that addition of an abrasion proof agent is possible if needed, it is more desirable for there to be nothing. It has the detergency which is a combination system with little sulfur content in a lubricating oil composition and in which the compounded oil with few chlorine contents was excellent from the above thing including alkyl salicylate calcium salt.

[0042]Example 3 and Example 4 are balancing the blending ratio of two or more sorts of alkyl

salicylate calcium salt of a metal system cleaning agent to the base oil ingredient which consists of the base oil A and the base oil B, It turns out that Example 3 and Example 4 serve as combination with the high pure capability to have exceeded the performance of the compounded oil of Example 1 and Example 2. If Example 1 is compared with Example 2, it has the detergency which was excellent, so that it did not change both efficiently, but it can be said that the Example 2 containing the alkyl salicylate calcium salt of the metal system cleaning agent B with little sulfuric acid ash is more advantageous. The value of sulfuric acid ash is the ash which measured weight mainly by making mineral matter into sulfate. As for what a difference comes out of to clarification performance although the sulfuric acid ash value in a lubricating oil composition is almost the same, the organic nature substance contained in the metal system cleaning agent B stabilizes and distributes in an oil under an elevated temperature, because the clarification performance is improved can be thought, and this is *****. Alkyl salicylate calcium salt with a lower sulfuric acid ash value can be referred to as excelling in the elevated-temperature clarification performance from the above thing.

[0043]

[Effect of the Invention] This invention was the lubricating oil composition which controlled the content of the chlorine compound in a constituent, and the sulfur compound, were the conditions by which prolonged continuous running is carried out, was able to raise the performance of heat resistance and a detergency substantially, and was able to reduce the environmental impact.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing 1 is a figure showing the outline of the hot tube testing machine used for evaluation of the detergency of a lubricating oil composition.

[Translation done.]

* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.

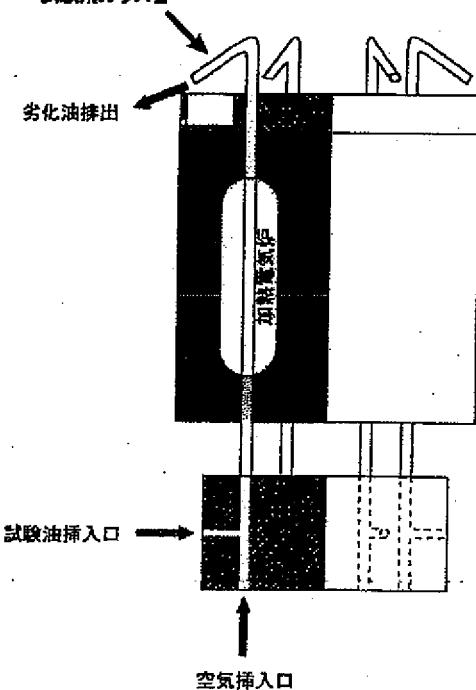
2. **** shows the word which can not be translated.

3. In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

試験用ガラス管



[Translation done.]